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PROBLEMS OF ANCESTRY.

Vorträge über botanische Stammesgeschichte, gehalten an der Reichsuniversität zu Leiden. Ein Lehrbuch der Pflanzensystematik. By J. P. Lotsy. Vol. i., Algen und Pilze. Pp. iv+828. (Jena: Gustav Fischer, 1907.) Price 20 marks.

THE motive inspiring the production of this important work is indicated on the title-page in the "motto" quoted from Coulter:—

"The most difficult as well as most fascinating problem in connection with any group is its phylogeny. The data upon which we base opinions concerning phylogeny are never sufficient, but such opinions usually stimulate research, and are necessary to progress."

Its pages show how stimulating the inquiry has been to the author, and we have seldom met with a book more likely to awaken inquiry in its readers or to suggest further research. Very different values may be placed on the conclusions as to the phylogeny of several of the groups, and on the characters regarded as of chief importance in forming the system of classification, and further information on many points is very desirable; but there can be only one opinion as to the manner in which the information is conveyed to the reader. Under each group is an admirably clear and full, yet concise, statement of the investigations that have been made upon it, and of their results, while an extensive classified bibliography refers the student to the original and full sources of information. Numerous illustrations, original or after those of the best monographs, add greatly to the usefulness of the work, and to its worth as an exponent of the most recent researches into the structure and cytology of the algæ and fungi.

The form of the book appears somewhat artificial, its substance being divided into thirty *Vorlesungen* of very unequal length, *e.g.* that on Exoascineæ (xxvi.) of four pages, and that on Basidiomycetes (xxx.) of eighty-eight pages. As these could scarcely have each been the subject of a single lecture, and as the longer *Vorlesungen* in some cases include several groups, this arrangement does not appear so convenient as the more usual division into chapters and sections.

The course of lectures opens with the discussion of what constitutes a living being, and of the agreements and differences between plants and animals, but very soon passes to the consideration of the simplest organisms as individual "energids," the multiplication of these, and the bodies built up of the combinations of "energids." An outline of the scheme of classification given early in the first lecture derives all plants from Protomastigina, and traces the supposed derivation of the several groups from these early forms, and their relations with one another. The system of classification of the green algæ is stated by Dr. Lotsy to be largely based on that set forth by Blackman and Tansley in 1902 in the "New Phytologist." Great importance is attached to the number and arrangement of the cilia borne by the reproductive cells, or at least by the male gamete; and these characters are employed in tracing the relationships between widely different groups, *e.g.* the Isokontæ are regarded as representing the ancestral condition of the Pteridophytes and seed-plants.

Scarcely less importance is given to the study of the "energids," or very simple units of individual life, the progress being traced from the monoergid to the polyergid organisation within the larger groups, with resultant advance in complexity of structure. That the conception is one of much value in stimulating inquiry cannot be disputed, but it may be questioned whether it is not carried too far in practically identifying the energid with the nucleus. The very different behaviour of the nuclei of the reproductive cells within a single family, and even within a single genus at times, especially among fungi, may well suggest the need of caution in such matters.

It is stated in the preface that the plan of the work was resolved on after perusal of a lecture by Dr. Hugo de Vries, in which a higher plant is regarded as a double organism. Dr. Lotsy was led to endeavour to trace out in theory how the return to the stage of a single organism is effected, and thus arrived at the conception of the two generations denoted as x and $2x$. The book before us embodies the effort to determine the extent of each of these generations, and in which groups of Thallophyta it is possible to detect them, the essential distinction between them being the well-known reduction in the number of chromosomes in the nuclei of the one generation to one-half those of the other. With this as a clue, Dr. Lotsy seeks to determine the relations of gametophyte and sporophyte in the Thallophyta, extending to these the conception of the alternation of generations so familiar in its applications to the Archegoniatæ. He shows a remarkable familiarity with the results of the most recent as well as of the classical researches into the structure and reproduction of the various families, and applies his leading ideas in a very consistent and able manner. We think that the known is still too limited to permit of a secure foundation being laid for the universal employment of such a criterion; but such a theory, applied with the author's thoroughness and width of view, must stimulate further investigation, and thus do excellent service in the study of botany. The doubts that must be felt with regard to the validity of some of the assumptions and conclusions will themselves lead to inquiries that must advance knowledge still more effectively. Several very important discussions of wide interest are introduced in relation to certain groups that illustrate them, *e.g.* that on the asexual cells and the gametes in Chlamydomonas leads to the consideration of the part taken by the nuclei in inheritance and artificial development of the egg under the stimulus of inorganic salts in solutions. Volvox gives further occasion of discussion on heredity, as does also Hydrodictyon, in which the effects of sugar and other substances on the methods of reproduction receive notice, and the relations of the x and $2x$ generations are compared with what occurs in Uredineæ. Illustrations of similar kind are introduced from among animals also. The functions

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of the various structures in cells are also discussed; *e.g.* the "vacuole" in Codiaceæ leads to the consideration of its nature, of the "tonoplasts" of de Vries, and of the granules of which protoplasm is built up. So under the bacteria their relations to other organisms as foes or as friends, and their importance in many and different aspects, are well set forth.

But it is needless to multiply examples of the many questions of extreme interest that find a place in the book, such as the existence and significance of "physiological species" among parasitic fungi, the very complex series of forms and relations to their hosts in Uredineæ, and others too numerous to mention.

Nor is it possible in a brief review to attempt to supply any adequate notice of the system of classification employed, or of the links shown or suggested to exist between the groups. The algæ and the fungi are not kept apart, but are grouped together into a system under the ideas explained above. In conclusion, we have to express the hope that this volume may in no long time be followed by the other two, which are to treat of the archegoniate and seed-forming plants. The author has earned the gratitude of botanists by placing within their reach an altogether stimulating book which should do much to win new workers to the absorbingly interesting Thallophyta.

THE COMMERCIAL USE OF PEAT.

Peat, its Use and Manufacture. By P. R. Bjorling and F. T. Gissing. Pp. xii+173; illustrated. (London: C. Griffin and Co., Ltd.) Price 6*s.* net.

THIS book contains a practical account of the different methods of preparing peat for commercial purposes, and of the uses to which peat can be applied. In NATURE of April 18, 1901, the attention of our readers was directed to the peat industry of Sweden, and its use there as fuel for generating steam both for stationary and locomotive engines; also in the number of May 31, 1900, to the exhibits at the Vienna Exhibition of that year of carpets, blankets, and clothing made from this material.

According to the authors of the book now under notice, there are $3\frac{1}{2}$ million acres of peat land in Great Britain and 6 million acres in Ireland. The peat varies in depth from 2 feet to 40 feet. Peat is also abundant in Canada, Denmark, Holland, Germany, Russia, and other countries.

The chief importance of this material at the present time is its value as fuel in districts where coal is scarce. Its great bulk as compared with coal, and its high percentage of water, have, however, hitherto proved obstacles to its extended use. The valuable portion of fuel is its carbon content, and in this respect peat is inferior to coal. An average sample of peat contains 42·7 per cent. of carbon, 4 per cent. of hydrogen, 27·4 per cent. of oxygen, 1·6 per cent. of nitrogen, and 2·4 per cent. of ash. In some specimens the carbon reaches as much as 66·55 per cent. of carbon. Wood contains 52 per cent. of carbon, brown coal 66 per cent., Swedish coal 78 per cent., and English steam coal 81 per cent.

The following results are given of the testing of peat fuel as against coal at Horwich, in Lancashire, under a steam boiler. Coal got up steam to 10 lb. pressure in 2h. 25m., and to 25 lb. in three hours. Peat fuel got up steam to 10 lb. in 1h. 10m., and to 25 lb. in $1\frac{1}{2}$ hours. Twenty-one hundredweight of coal maintained steam at 30 lb. pressure for $9\frac{3}{4}$ hours, whilst $11\frac{1}{4}$ cwt. of peat fuel maintained steam at the same pressure for 8 hours.

Peat has been used on the Bavarian railways for more than sixty years, and has been found economical. It is claimed for peat that, being free from sulphur, it has a much less detrimental effect on the heating apparatus than coal or coke. As regards cost, pressed peat costs 7*s.* 4*d.* per ton, Saxony coal 4*s.* 9*d.*, and Ruhr coal 5*s.* 5*d.*; but if cost of carriage be taken into consideration, the peat is 7*s.* 4*d.* against 8*s.* 11*d.* and 9*s.* 8*d.* for the coal.

Experiments were made on the Hartford and Springfield Railway, when a locomotive engine ran in express time 52 miles with 14,000 lb. of peat; and it was found that two-thirds of a ton of peat was equal to one ton of coal for locomotive purposes. Several other trials made with peat for locomotive purposes are given by the authors, and there is no doubt in countries where coal is scarce and peat plentiful the peat bogs may be utilised with very great advantage.

Gas has also been made from peat with very successful results, and in Sweden it has been used for regenerating, puddling, and open-hearth furnaces for the last thirty years. It has also given very satisfactory results for illuminating purposes in Ireland. From a single pound weight of peat one hour's light can be produced; in some peat there is as much as 14,000 cubic feet of gas per ton. In Sweden a ton of peat was found to yield 9295 cubic feet of gas of twenty-four candle-power, a ton of English coal tested at the same time yielding 7063 cubic feet of gas of fifteen candle-power, the by-products being also largely in favour of the peat. Paraffin for candle-making is also distilled from peat.

Another use to which peat has been largely applied is in the manufacture of paper, which dates back in Ireland to 1835. Yarn for weaving purposes is also made from peat. There is now being sold by Messrs. Doré and Son, of London, underwear manufactured from peat. It is also considered an excellent material for bandages and surgical purposes. The other uses to which peat can be applied are numerous, even alcohol being obtained.

The greatest problem encountered in the manufacture of peat fuel is the extraction of the moisture from the peat. There are three general processes in use—air, pressure, and heat. The former is best in a country where a sufficient period of dry weather can be counted on. The various methods resorted to are described by the authors of this book, and illustrations of the machinery given. The latest process for converting peat into fuel is by electricity, which has been tried in Ireland. The peat, after being raised from the bog, is delivered into a rotary hydro eliminator, in which it is subjected to a gradually increasing pressure. The eliminator is

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